

GRADES

K-2

Getting on an Airplane

parts of an airplane

Aeronautics
Research
Mission
Directorate





(Photo courtesy of NASA - www.nasaimages.org)

Getting on an Airplane

Lesson Overview

In this lesson comprised of three activities, students will learn about properties of objects and materials, and position of motion and objects through song, simple choreography, and classroom activities about the main parts of an airplane. Students will also learn the function of these parts as they relate to flight.

Objectives

Students will:

1. Identify the following parts of an airplane given a simple diagram: fuselage, cockpit, propeller (or jet engines), tail, horizontal stabilizer, elevator, vertical stabilizer, rudder, wings ailerons, and wing flaps.
2. Explain in simple terms the function of each part they name.
3. Pitch, roll and yaw using their bodies.
4. Lift and drag using their bodies.

Materials:

In the Box

Song file "I'm Getting on an Airplane" can be downloaded from the MIB website:
<http://www.aeronautics.nasa.gov/mib.htm>

Provided by User

Chart paper, white board or chalkboard

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Time Requirements: 1 hour 30 minutes

parts of an airplane

Background

Airplanes are heavy and massive, which may make them seem impossible to be able to fly. Even though these metal machines, which are often also filled with many pounds of cargo, are extremely heavy, they have specialized parts and a design that allows them to lift off the ground and move through the air safely for many hours.

While there are many parts to an airplane, the basic parts include the fuselage or body, wings, tail, and jet or propeller-driven engines, depending on the size and model of the airplane. Each of these larger parts have even more specialized parts. The fuselage is made up of the cockpit, which includes the seating and instruments for the pilot and sometimes the co-pilot, and the body of the plane, which may carry passengers, cargo or both. The wings of the airplane include ailerons and wing flaps, and depending on the size and model of the plane, may have the engines attached as well. Finally the tail of the airplane is made up of two main parts, the vertical stabilizer and the horizontal stabilizer. Each of these parts has a role to play in the flight of the airplane.

The wings of an airplane generate most of its lift, the force that keeps the airplane up in the air. To generate lift, air needs to flow over the aircraft or other lifting body (such as a kite or a glider). In the case of an airplane engine, the thrust generated by the engine can help produce or increase the airflow over the airplane, helping the airplane fly. Increased airflow adds more lift. The resistance to thrust is referred to as drag. Drag is a kind of aerodynamic friction. When studying lift, the weight of an airplane is lift's resistive force. Smaller, low-speed airplanes use propellers instead of jet engines. Lift, weight, drag, and thrust are together called the four forces of flight.

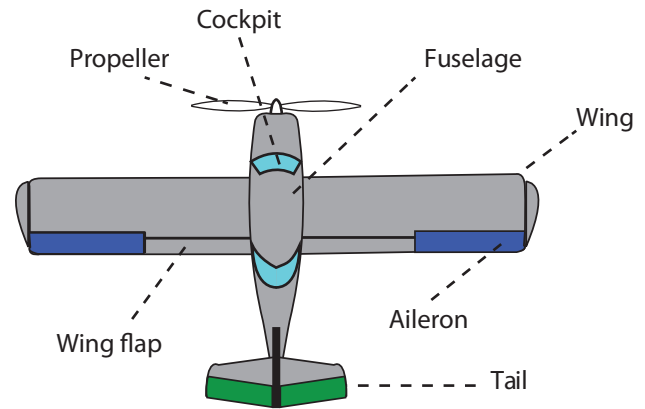


Fig. 1 Propeller powered airplane

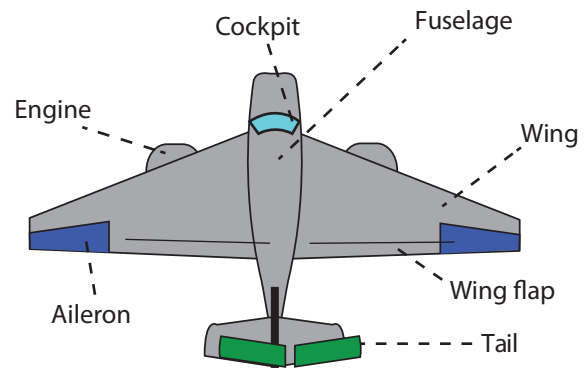


Fig. 2 Jet-engine powered airplane

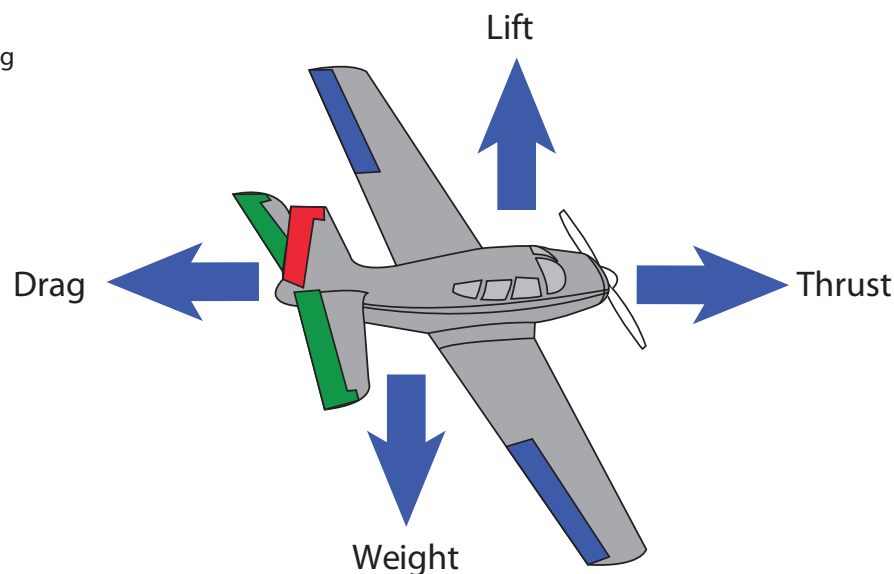


Fig. 3 The four forces of flight

Wings are used to control and maneuver the airplane. Smaller wings located on the tail of the airplane are called stabilizers. The fixed horizontal tailpiece is called the horizontal stabilizer, and the fixed vertical tailpiece is called the vertical stabilizer. The job of the stabilizers is to keep the airplane flying straight. The vertical stabilizer keeps the nose of the airplane from swinging from side to side, a motion called yaw. The horizontal stabilizer controls pitch, or the up-and-down motion of the nose of the airplane.

On the edges of each stabilizer are small moveable flaps attached by hinges. The hinged part on the vertical stabilizer is called the rudder. The rudder directs the nose of the airplane to the left or to the right (yaw). The hinged part of the horizontal stabilizer is called the elevator, which is used to direct the nose of the airplane up or down (pitch).

The wings of an airplane have similarly hinged parts: ailerons, which are used to roll the wings from side to side and the wing flaps, which are located closest to the fuselage. During takeoff as well as landing, the wing flaps are directed downward in order to increase the amount of lift produced by the wings.

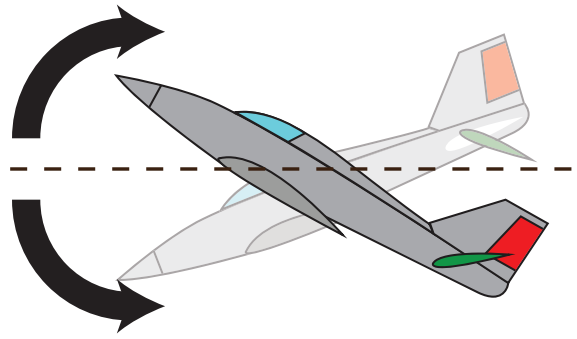


Fig. 4 Pitch

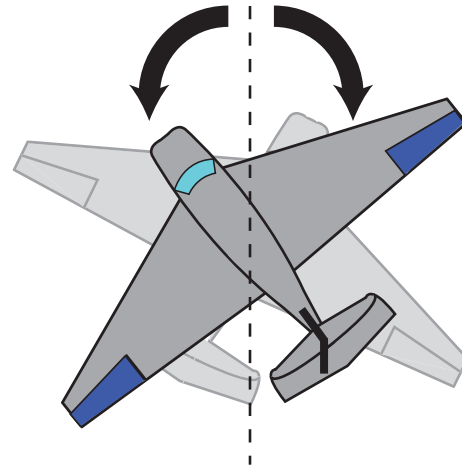


Fig. 5 Yaw

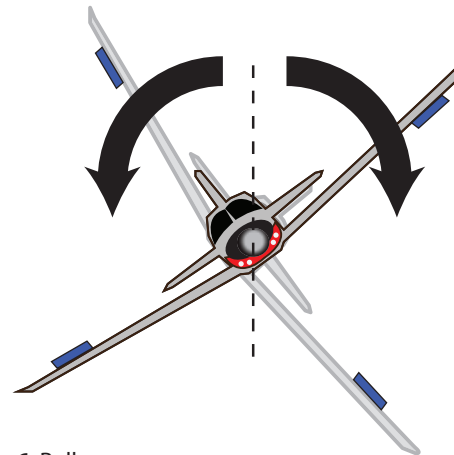


Fig. 6 Roll

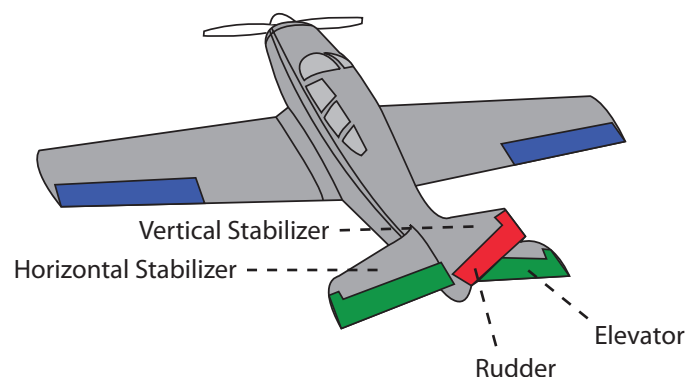


Fig. 7 Airplane tail parts

Activity 1

Learning the Parts of an Airplane

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Time Requirement: 30 minutes

Materials:

In the Box

Song file "I'm Getting on an Airplane"
(downloaded from:
<http://www.aeronautics.nasa.gov/mib.htm>)

Provided by User

Chart paper, white board
or chalkboard

Worksheets

Airplane diagram
(Worksheet 1)
[2 copies per student]

"I'm Getting On An
Airplane" Lyrics
(Worksheet 2)

Reference Materials

None

Key Terms:

Ailerons
Cockpit
Elevator
Engine
Fuselage
Horizontal Stabilizer
Propellers
Rudder
Tail
Vertical Stabilizer
Wing flaps

Objective:

In this activity, students will learn about the properties of objects and materials, and the abilities of technical design as they utilize prior knowledge regarding airplanes. Also, they will record questions they have about airplanes and how airplanes fly and identify the main parts of an airplane using labeled and unlabeled drawings. Those parts include fuselage, wings, tail, vertical stabilizer, horizontal stabilizer, rudder, elevator, ailerons, wing flaps, engine, propellers, and cockpit.

Activity Overview:

Using a KWL (Know, Want to know, Learned) chart, students will first utilize prior knowledge they have about airplanes. Next, students will generate questions they have about airplanes. Before listening to the song at the center of the activity, students will label a blank diagram of an airplane as best they can. Students then will be introduced to the song, "I'm Getting on an Airplane", which they will eventually sing. Finally, after listening to and singing along with the song, students will label a blank diagram of an airplane again, this time with greater accuracy.

Activity:

1. Have a KWL chart drawn on chart paper or a board that looks like this:

K What do we already know about airplanes?	W What do we want to know about airplanes?	L What have we learned about airplanes?

2. **Begin by asking students:** *Who has ever been on an airplane?
What was it like?*
3. **Next, ask the students:** *What do we already know about airplanes?*
4. **Tell the students that you are going to put their answers about what they already know in the K (or KNOW) column of the KWL chart you have drawn.** Begin writing student responses about what they already know. Redirect answers that are inaccurate, combing out what you know to be true and rephrasing the students' responses in order to make them more accurate or realistic.
5. **Now, ask students:** *What don't you know about airplanes that you wish you knew?
What questions do you have about airplanes?*
6. **Tell the students that you are going to put their question ideas in the W column of the chart because those are things we WANT to know.**
7. **Tell the students that by the end of the lesson all of the things they learned will be recorded in the final column, the L or what we have LEARNED column.**
8. **Now, show the students the blank diagram of an airplane (worksheet one) and ask them to name as many of the parts they can.** Teachers may write on the diagram directly or use labels that may be attached to the diagram.
9. **Next, tell the students that they are going to listen to a really fun song called "I'm Getting on an Airplane".** The song will teach them about two things, the major parts of an airplane and what these parts do. Tell them that today's focus will be on learning the parts of an airplane.
10. **Either pass out copies of the song lyrics or use a projector to display the lyrics.** Teachers may choose to read through the lyrics with the students before the song is played.
11. **Play the song 2 to 3 times, each time, encouraging the students to sing along any time they feel ready.** The song is 2:53 (2 minutes and 53 seconds long).
It might be fun to have the students pretend to play a trumpet during the parts of the song where it sounds like a horn is being played.
12. **After playing the song 2 to 3 times, show the students a blank airplane diagram again.** Have students identify parts and part locations again, either moving around the labels or labeling the diagram.

13. **As an alternative, older students may be asked to label a blank diagram of an airplane similar to the diagram the teacher is using as a post-lesson quiz.**
14. **End the lesson by asking the students what they learned today.** Record their answers in the L column of the KWL chart.

NATIONAL SCIENCE STANDARDS K-2

SCIENCE AS INQUIRY

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

PHYSICAL SCIENCE

- Property of objects and materials

SCIENCE AND TECHNOLOGY

- Abilities of technological design
- Understanding about science and technology

Activity 2

Learning the Function of the Parts of an Airplane

GRADES

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Time Requirement: 30 minutes

Materials:In the Box

Song file "I'm Getting on an Airplane"
(downloaded from:
<http://www.aeronautics.nasa.gov/mib.htm>)

Provided by User

KWL chart
(from **Activity One**)

Worksheets

Airplane diagram
(Worksheet 1)

"I'm Getting On An Airplane" Lyrics
(Worksheet 2)

Reference Materials

None

Key Terms:

Pilot
Pitch
Roll
Yaw

Objective:

In this activity, students will learn about the properties of physical objects and materials, and about the abilities of technological design when they review the names and locations of the airplane parts they have learned. They will also learn, in simple terms, the function of each part they learned previously as it relates to pitch, yaw and roll and demonstrate pitch, yaw, and roll using their bodies.

Activity Overview:

After reviewing the airplane parts they have learned, students will learn the function of each part using the lyrics of the song "I'm Getting on an Airplane". Additionally, students will learn the airplane movements of pitch, yaw and roll and demonstrate those movements using their bodies.

Activity:

1. Refer to the **Activity One** diagram to review the airplane parts and part locations students learned previously.
2. Tell students that they will expand their knowledge about airplanes today by learning what each of the parts of an airplane do, and how each part helps the airplane take flight.
3. Distribute or display lyrics for "I'm Getting on an Airplane". Listen to the song, again encouraging students to sing along.
4. Before listening to the song again, have the children pretend to be airplanes. Ask them to move around the room as if they were airplanes. Carefully observe their movements for examples of pitch, yaw and roll.
5. When a good example of pitch, yaw or roll is observed, ask the students to freeze. Choose the student whose movements demonstrate pitch, yaw, or roll. Ask that student to demonstrate his or her movement again for the rest of the class while the teacher explains what that movement is called.

6. **Before proceeding, make sure students understand who flies the airplane.** Ask them what name that person is given (*pilot*).
7. **Go back to the movements just introduced.** Explain how the pilot controls each movement and what part of the airplane is involved. The movement chart below will help you identify and explain pitch, yaw and roll and may be posted for the students to see as well.

Technical Term	Airplane Movement	Use of Airplane Part
Pitch	The nose of the airplane slants up or down.	Pilots use the elevators on the vertical stabilizers to control pitch.
Yaw	The nose of the airplane moves side to side on the horizontal axis.	Pilots use the rudder on the horizontal stabilizer to control yaw.
Roll	The entire airplane tilts to the left or the right.	Pilots use the ailerons to control roll.

8. **Display the diagrams showing pitch, yaw and roll.**
9. **Guide the students to use their bodies to create pitch, yaw and roll.** Begin by dividing the students into pairs. Then begin using the movements described below to model the flight of an airplane (Fig. 8, 9, 10).



Fig. 8 Yaw



Fig. 9 Pitch



Fig. 10 Roll

Airplane Movement	Body Movement (from airplane pose)
Pitch	<p>Have each student stand with their arms outstretched, pretending they are wings.</p> <p>Next, have them bend forwards and backwards at the waist while keeping their head upright. This demonstrates the effect the elevator has on the airplane.</p>
Yaw	<p>Have one student in each pair (Student A) stand with his or her arms outstretched, representing wings. Have the other student in the pair (Student B) place his or her hands on Student A's waist. Now, have Student B twist student A around the waist.</p> <p>This demonstrates the effect the rudder has on the airplane.</p>
Roll	<p>Place both students' chairs together so that Student A can lay face down on them, again with his or her arms outstretched. Have Student B hold the arms of Student A, rolling them from side to side on the chair.</p> <p>This demonstrates the effect ailerons have on an airplane.</p>

10. **Listen to the song again.** This time students will demonstrate pitch, yaw and roll as the singer brings up each movement in the song. Until then they may use their bodies to make other motions. See the suggestions below.
- a. Song lyrics "I'm getting on an airplane" – students march
 - b. Song lyrics "How does the plane fly?" – students tap finger to chin with questioning look
 - c. Song lyrics "There are many parts to an airplane" – students use right index finger to point in front of them, bouncing finger in the air from right to left
 - d. Song lyrics "To keep it moving through the sky" – arms in wing positions, tilting up and down
 - e. Song lyrics "It carries people and cargo" – put one hand out in front of body, slightly cupped, then with the other hand do the same
 - f. Song lyrics "The pilot sits in the cockpit..." – pretend to grip steering wheel at the 10 and 2 positions and steer
11. **Ask students:** *When do you think a pilot has to rely on or use pitch, yaw and roll?*
Answers might include the following:
- a. *Pitch is used to ascend or descend.*
 - b. *Yaw is used to change course of the nose of the airplane.*
 - c. *Roll is used to change course (heading) of the airplane.*
12. **Finally, return to the KWL chart from Activity One.** Ask the students what they learned today. Record their responses in the L column of the chart.

NATIONAL SCIENCE STANDARDS K-2

SCIENCE AS INQUIRY

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

PHYSICAL SCIENCE

- Property of objects and materials

SCIENCE AND TECHNOLOGY

- Abilities of technological design
- Understanding about science and technology

Activity 3

Learning About Thrust, Drag and Lift

GRADES**K-2****Time Requirement:** 30 minutes**Materials:**In the Box

Song file "I'm Getting on an Airplane"
(downloaded from:
<http://www.aeronautics.nasa.gov/mib.htm>)

Provided by User

KWL chart
(from **Activity One**)

Worksheets

Labeled airplane diagram
(Worksheet 1)

I'm Getting On An Airplane Lyrics
(Worksheet 2)

Reference Materials

None

Key Terms:

Cargo
Drag
Lift
Thrust

Objective:

In this activity, students will learn about the position and motion of objects, and about the abilities of technical design by reviewing what they have learned so far from **Activities One and Two**. They will learn the basics of the four forces of flight: thrust, drag, weight, and lift. They will also learn which parts of the airplane are involved in thrust, drag and lift and demonstrate thrust, drag and lift using their bodies.

Activity Overview:

After reviewing the concepts they have learned about airplanes so far, students will learn the four forces of flight: thrust, drag, weight and lift. Students will learn that the jet engines or propellers on airplanes provide thrust, wings provide lift, and drag and weight are forces that lift and thrust must overcome.

Activity:

1. **Begin by reviewing all of the concepts learned by the students thus far including parts of an airplane and how those parts work.**
2. **Play the song again while students sing along, moving their bodies along with the song mimicking the movements they have learned so far.**
3. **Ask:** *What materials are used to make an airplane?*
(Responses will vary but may include metal)
4. **Ask:** *What do you think makes airplanes heavy?*
Why?
(Responses will vary but may include: They're made of metal and carry people and other heavy things.)
5. **Ask:** *So if airplanes are so heavy how do they get off of the ground?*
(Responses will vary but may include: They fly.)
6. **Ask:** *How do airplanes fly?*
(Responses will vary.)

7. **Say:** *Let's look at our diagram of an airplane. Which parts do you think are used to get the airplane to fly in the air?*
(Responses will vary but may include wings and engine.)
8. **Tell students that the engine or propellers provide the power to move the airplane forward, but the wings are needed to lift the airplane into the air.**
9. **Say:** *The force the jet engines or propellers provide is called thrust. Thrust from the engines cause air to flow over the wings and over the other parts of the airplane. Air flowing over the wings causes the plane to get off the ground. This is called lift.*
10. **Ask:** *What forces do you think want to keep the airplane from moving forward and lifting into the air?*
(Answers will vary but may include the size or weight of the airplane and the wind.)
11. **Remind the students that an airplane is heavy because it carries people and cargo (the items people want or need).** Tell students that it is the weight itself that acts as a force to keep the airplane on the ground. And, when the airplane finally does overcome the weight and lifts off of the ground and thrust pushes the plane through the air, the air starts pushing back on the airplane. This is a force called drag or air resistance.
12. **In order to give the students a better understanding of drag, explain how a parachute uses drag to keep the jumper from falling too fast.**
13. **Explain the relationship between thrust and drag.**
Greater thrust increases the capacity to overcome drag.
14. **Show students a diagram of the four forces of flight (Fig. 3).**
15. **Explain how the wing flaps (the final airplane part to discuss) are used to control drag.** When the flaps are up (meaning in a neutral position – even with the wing surface), drag is decreased. When the flaps are down, drag is increased.
16. **Ask:** *When might a pilot want to increase drag?*
(Responses will vary but may include slowing the airplane down or braking.)
17. **Ask:** *When might a pilot want to decrease drag?*
(Responses will vary but may include when the pilot wants to speed up.)

18. **Remind the students about their “airplane pose” from Activity 2.** Tell the students that you are going to play the song again. This time when they hear the singer mention thrust they should move forward in their airplane pose. When they hear the singer mention lift, they should maintain their airplane pose while bending at the knees and squatting down when they hear “down” and standing on their toes when they hear “up”. Finally, when they hear “drag,” they should move forward, faster first then slow, depending on the song lyrics.
19. **Practice the movements with the students before playing the song.** Then play the song and have the students move around adding thrust, lift and drag to the set of body movements they have already learned.
20. **Play the song one more time and conclude the activity by adding to the L column of the KWL chart.**
21. **Review everything the students have learned, pointing to the various diagrams and charts to illustrate each concept.**
22. **Conclude the lesson by giving students a picture of an airplane, which they will label.** Under the picture students will write three sentences about what they learned about airplane parts and flight.

NATIONAL SCIENCE STANDARDS K-2

SCIENCE AS INQUIRY

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

PHYSICAL SCIENCE

- Property of objects and materials

SCIENCE AND TECHNOLOGY

- Abilities of technological design
- Understanding about science and technology



Reference Materials

Glossary

Aileron:

Flap on an airplane wing responsible for roll (tilt)

Cargo:

Goods carried as freight on an airplane

Cockpit:

The part on an airplane that houses the pilot

Drag:

One of the forces of flight; resistance to motion

Elevator:

Flap on an airplane tail that controls climb and descent

Engine:

A source of power or thrust for an airplane

Fuselage:

The airplane body

Horizontal Stabilizer:

Part of the tail; prevents the up-and-down motion of the airplane nose, also called pitch

Lift:

The force that opposed the weight of an airplane, causes the airplane to lift into the air

Pilot:

The person flying the airplane

Pitch:

The up and down movement of the airplane nose; controlled by elevator on the tail

Propeller:

Revolving curved wood or metal object on an airplane that provides source of power or thrust

Roll:

The tilt of the airplane to the right or left

Rudder:

The small moving section at the rear of the stabilizer that is attached to the fixed sections by hinges; controls the yawing motion of the airplane

Tail:

Located at the rear of the airplane; provides stability; it usually has a fixed horizontal piece, called the horizontal stabilizer, and a fixed vertical piece, called the vertical stabilizer

Thrust:

A force generated by the airplane's engine, which moves an airplane forward through the air. Thrust is used to overcome the drag of an airplane

Vertical Stabilizer:

The vertical wing-like part of the tail that keeps the nose of the plane from swinging from side to side, which is called yaw

Wing flaps:

Hinged flaps attached to the back edge of a wing located nearest the fuselage; flaps are deployed downward on takeoff and landing to increase the amount of lift produced by the wing

Yaw:

Side to side movement of an airplane

Fig. 1 Propeller powered airplane

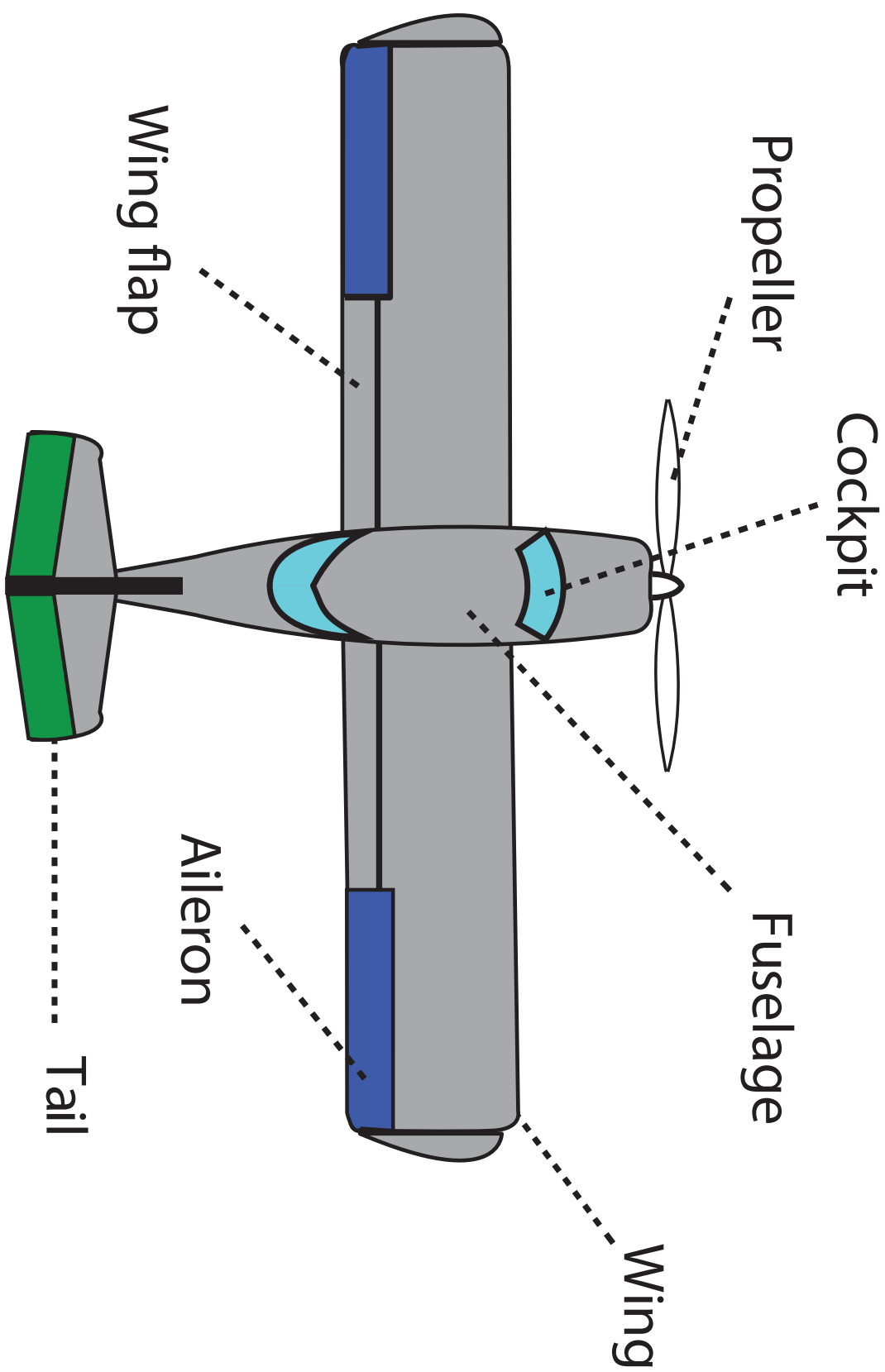


Fig. 2 Jet-engine powered airplane

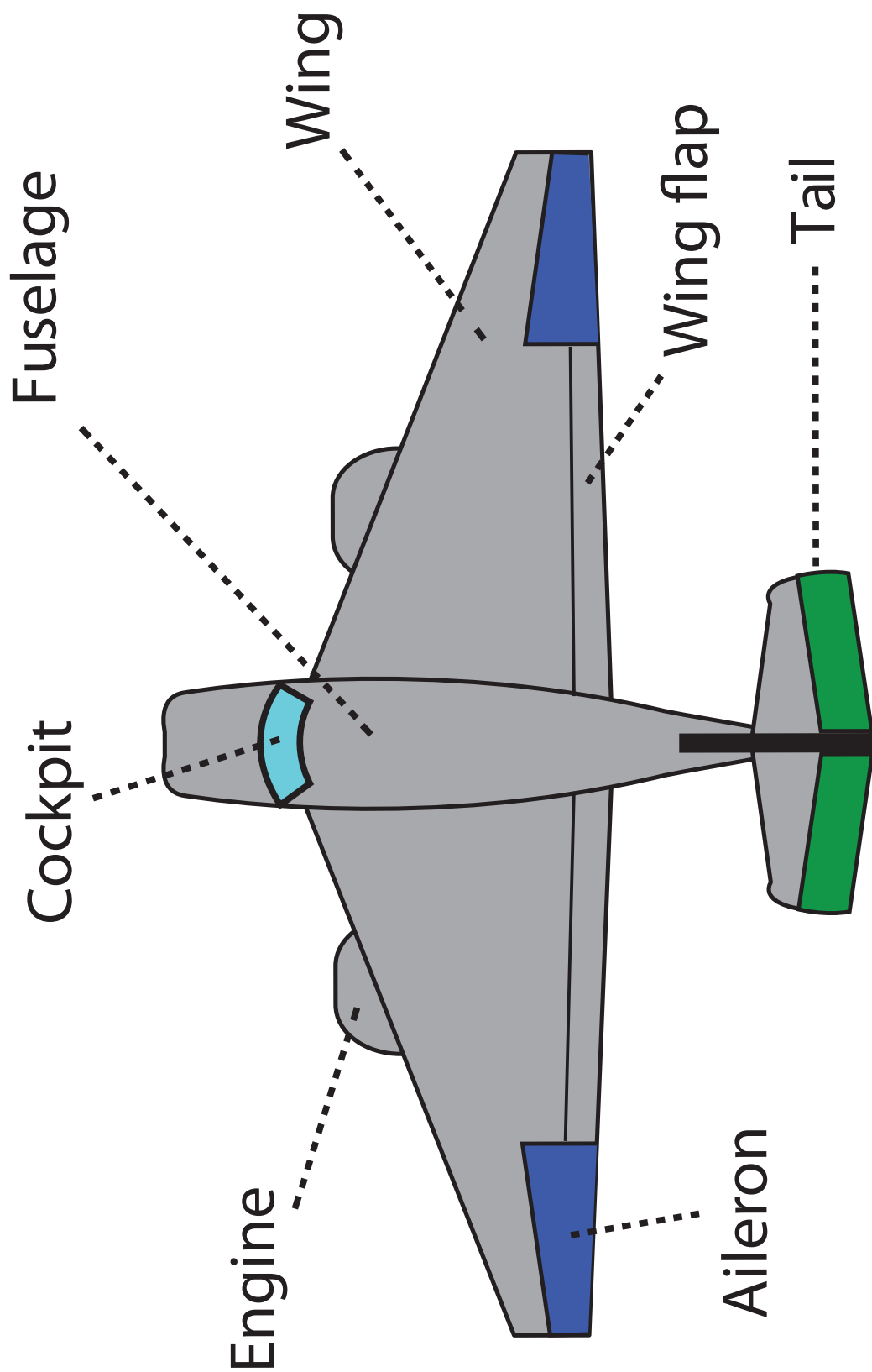


Fig. 3 The four forces of flight

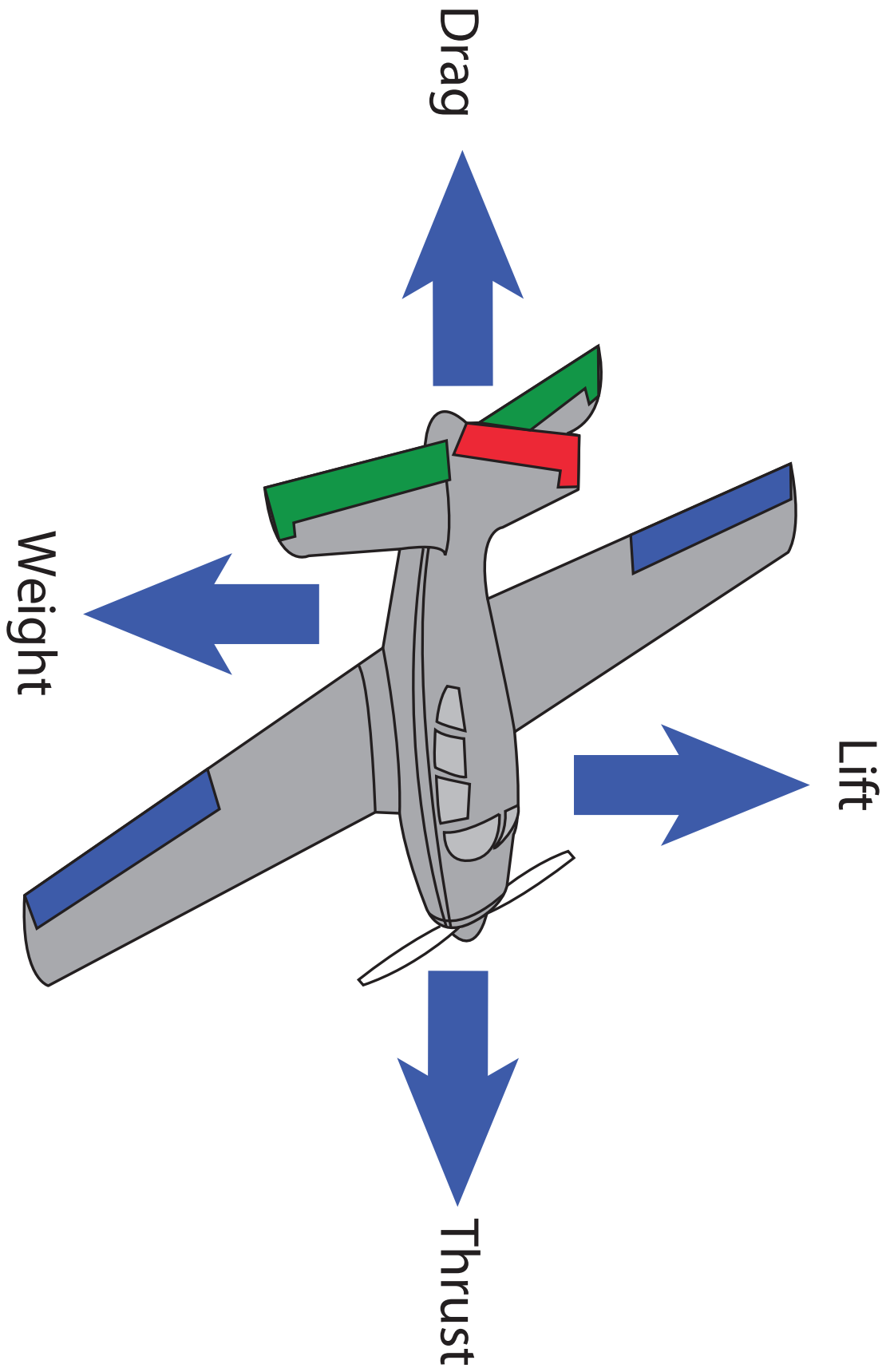


Fig. 4 Pitch

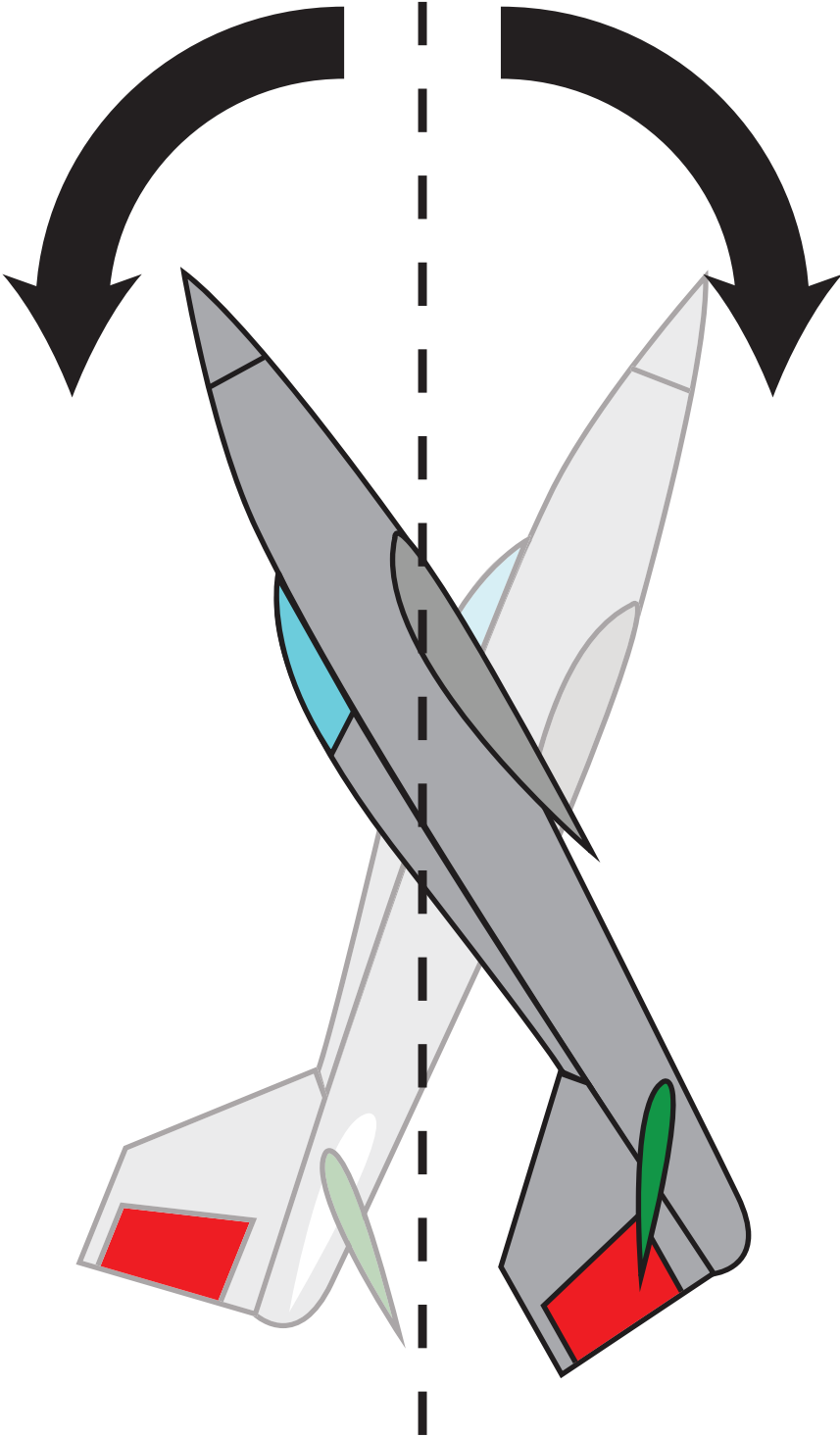


Fig. 5 Yaw

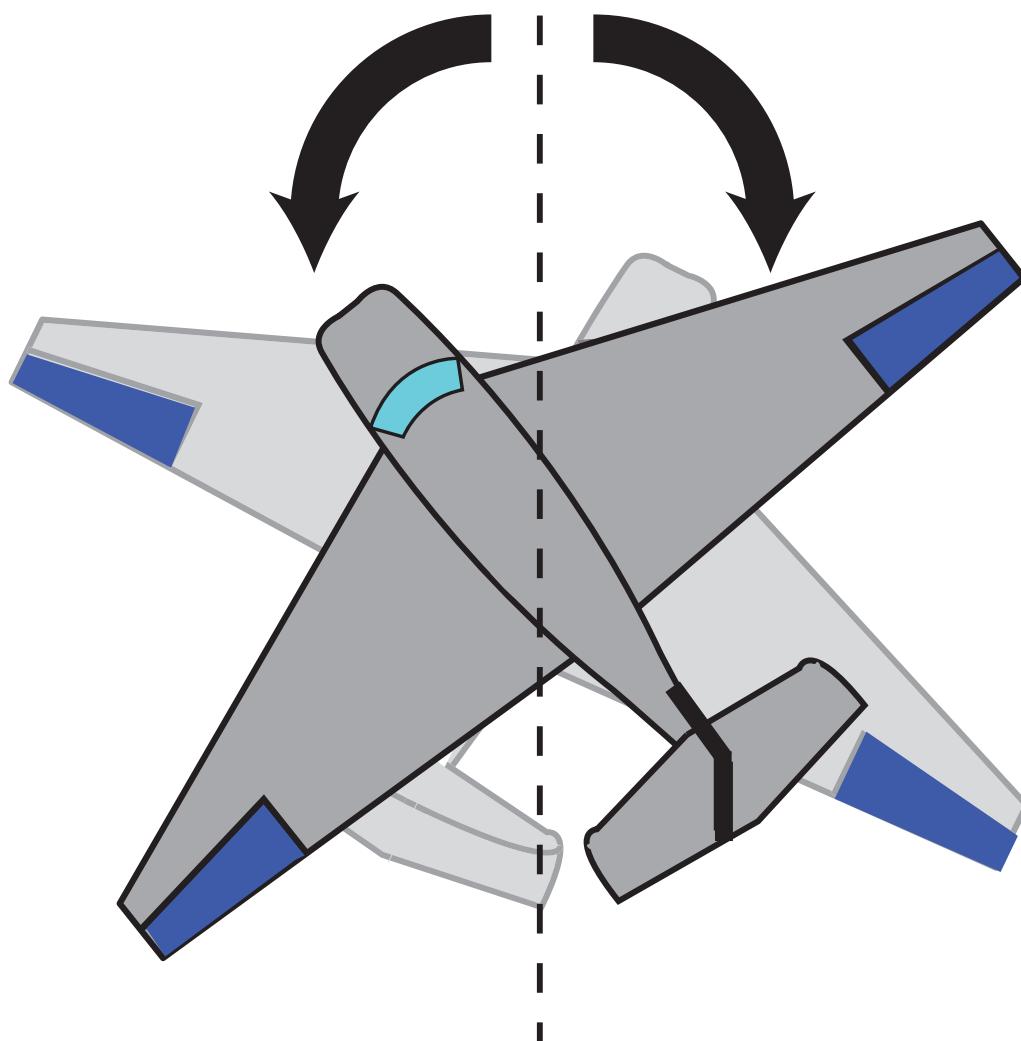


Fig. 6 Roll

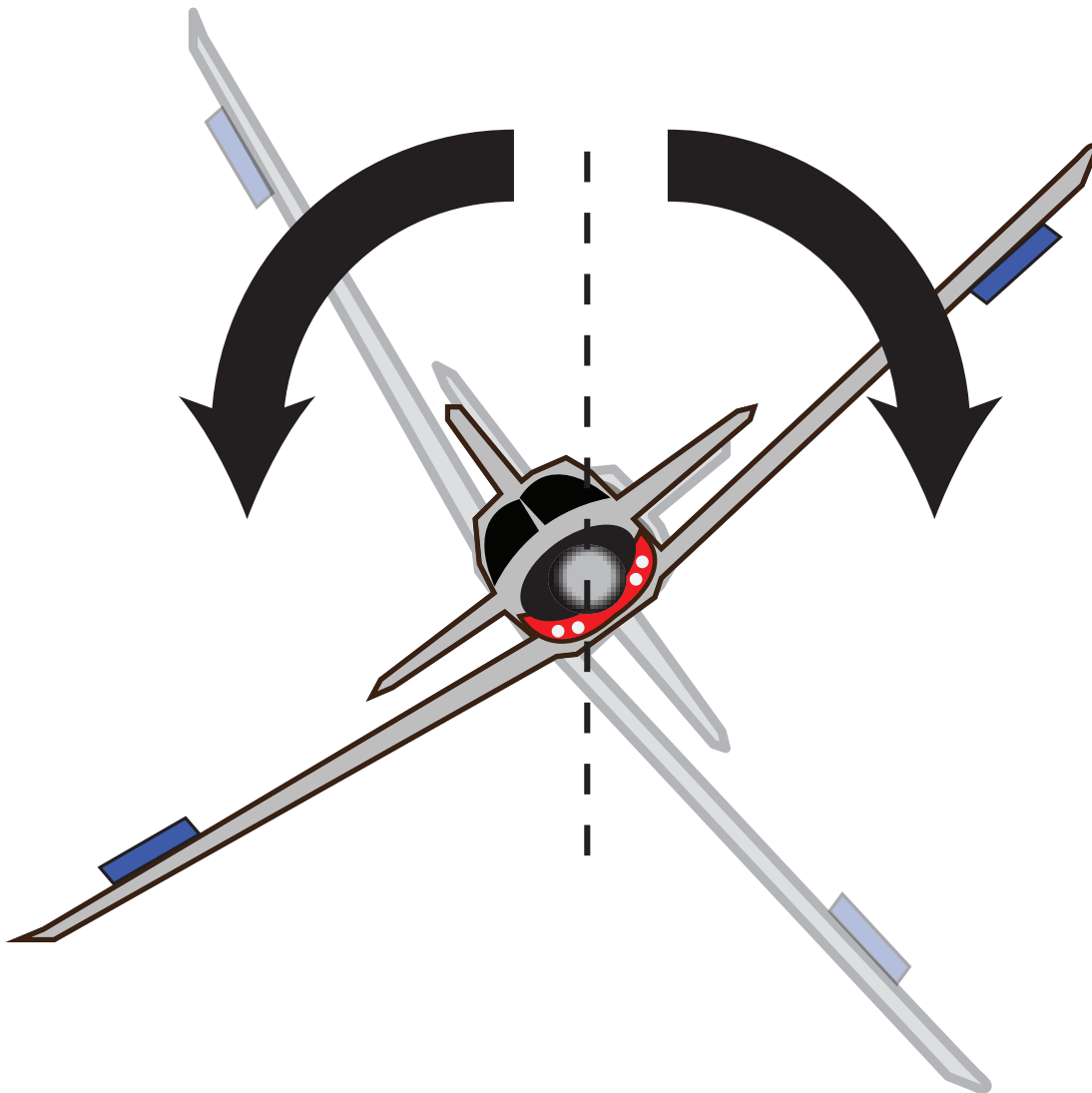


Fig. 7 Airplane tail parts

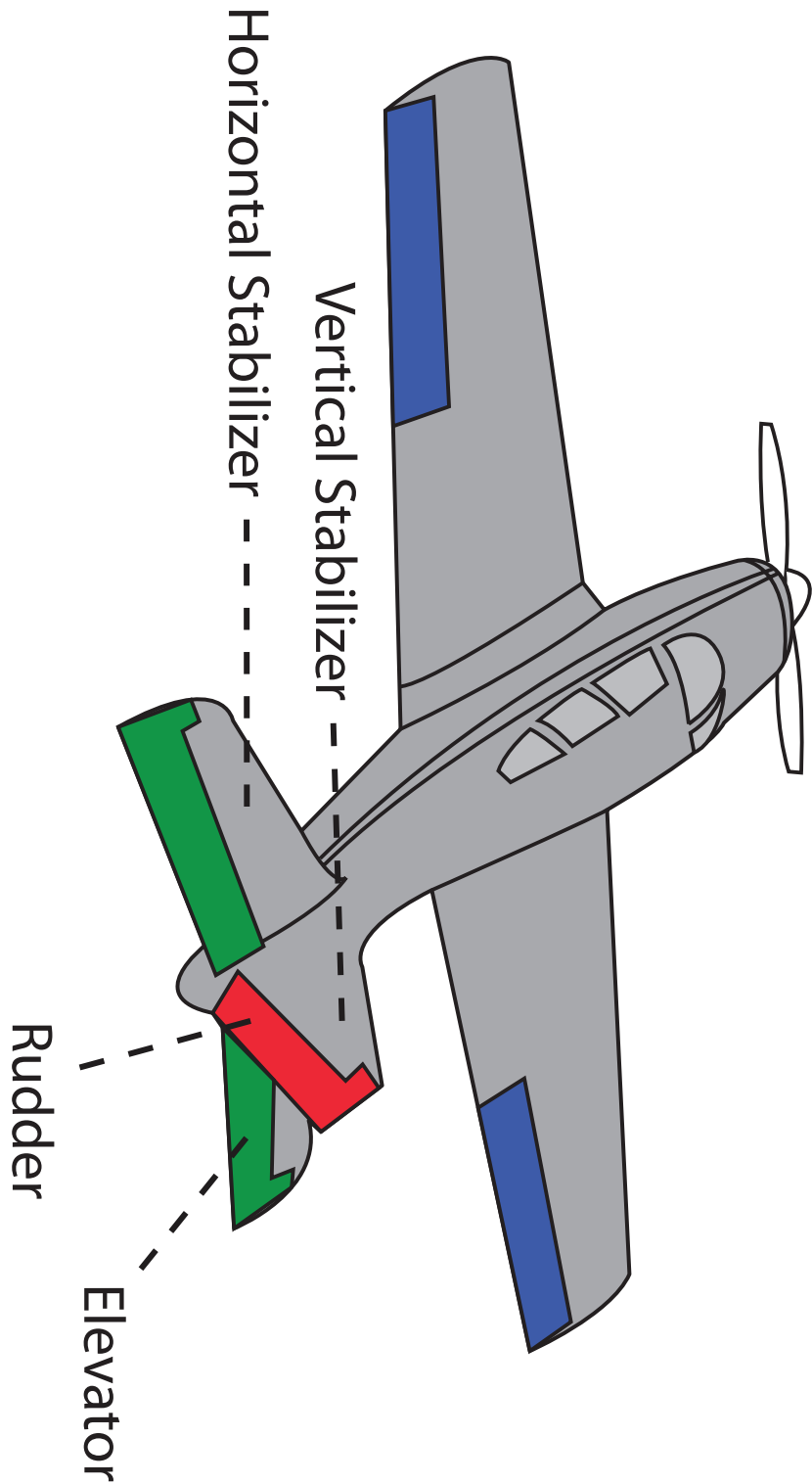


Fig. 8 Yaw



Fig. 9 Pitch

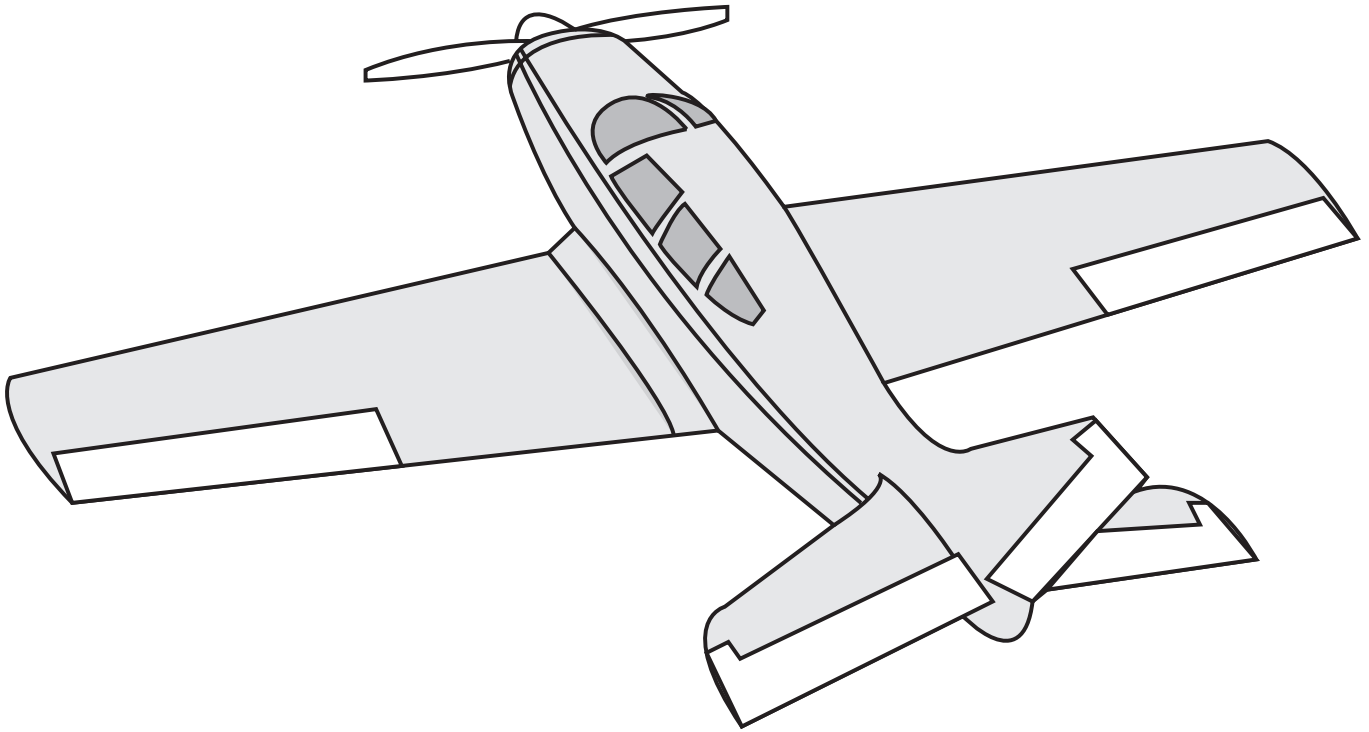


Fig. 10 Roll





Student Worksheets



I'm gettin' on an airplane, but how does a plane fly?
There are many parts in an airplane, to keep it movin' through the sky
I'm gettin' on an airplane, but how does a plane fly?
There are many parts in an airplane, to keep it movin' through the sky

The body is the fuselage, it carries people and cargo
The pilot sits in the cockpit, for command and control
Jet engines or propellers provide the needed thrust
In order to lift the plane in the air, wings are a must

I'm gettin' on an airplane, but how does a plane fly?
There are many parts in an airplane, to keep it movin' through the sky

In the tail of the plane, are some smaller wings
They keep the craft flying straight, a very important thing
The horizontal stabilizer controls the pitch
The vertical stabilizer controls the yaw – but that's not all...

There are many hinged parts that bring about change
Let's describe them, and see how they affect the plane
The flaps change lift – up and down
And they change drag – fast and slow
The ailerons cause tilt – that's called roll
Left up – roll left, right up – roll right
The rudder changes yaw – side to side
The elevators change the pitch

I'm gettin' on an airplane, but how does a plane fly?
There are many parts in an airplane, to keep it movin' through the sky
I'm gettin' on an airplane, but how does a plane fly?
There are many parts in an airplane, to keep it movin' through the sky
I'm gettin' on an airplane.

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